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Lubrication

A Technical Publication Devoted to the Selection and Use of Lubricants

THIS ISSUE

Lubrication of Materials Handling Equipment

(The Electric Crane, The Ore Bridge, The Car Dumper, Etc.)

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LUBRICATION

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Courtesy of The Wellman-Seaver-Morgan Company

Fig. 1—The handling of coal, showing two conveyor bridges of the cantilever type, the nearest with latter elevated.

Lubrication of Materials Handling Equipment

The Electric Crane, The Ore Bridge, The Car Dumper, etc.

MATERIALS handling is one of the essential problems of industry today. For industrial production depends upon the efficiency with which products are moved through the various stages incident to manufacture. Where handling in bulk is involved, the more pertinent may the problem become; for example, moving or transportation of ore, coke or coal could easily present more difficulties than the handling of steel ingots or billets. The machinery involved is generally more massive, more varied and usually located in the open. Ore, coal and coke are subject to outdoor storage, and until actually delivered to blast furnaces, ovens or boilers must remain in the yards or bins.

The receiving and handling of such materials must, therefore, be studied not only with a view to proper locality in the plant prior to usage, but also relative to proper care of the machinery involved.

This latter is essentially a matter of lubrication. To explain, the majority of the repairs or replacements necessary on the average crane, hoist, car dumper, etc., can be attributed to lack of proper lubrication. There are a number of reasons for this. Such equipment is massive, the wearing elements such as gears, chains, bearings and wire rope are located in more or less inaccessible places, practically all are exposed to the weather, and dust or dirt are always present. In view of the above it is,

perhaps, pardonable for certain operators, in blissful ignorance, to regard lubrication as a waste of time and as an ineffectual procedure.

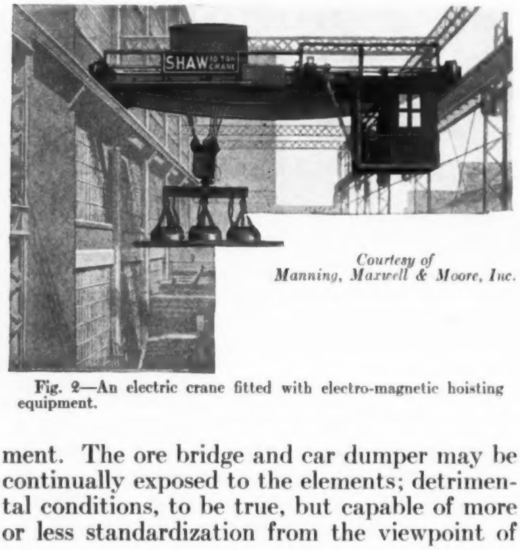
They are wrong, however, the more severe these operating conditions may be, the more attention should be given to lubrication. Of course it is not an eliminant of wear, but it is a mighty good reducer. For a moment realize the effects of proper lubrication on the cost of upkeep of your motor car, and then think of the potential reductions possible if you give the same care and attention to lubrication of your coal, ore and coke handling equipment.

THE ELECTRIC CRANE

By virtue of its flexibility and adaptability the electric crane can well be said to be the keystone unit in economical industrial production. In fact in some one of its many varieties ranging from the crudest form of jib crane to the most modern overhead traveling device, it is a vital factor in practically every industry where bulky materials or products must be moved with precision, rapidity and expedience.

A typical example is the iron and steel industry, where from the ore pile to the shipping department, the crane is the primary means of moving the product. Visualize the ladle crane for handling molten metals; the ingot stripping crane which removes ingots from their moulds; the ingot charging crane used in connection with the soaking or heating pits; the cranes which charge the open hearth furnaces; and those which transfer steel plates and shapes from cooling racks to storage, and thence to cars or boats for shipping.

In consequence crane service is perhaps the most varied of any materials handling equipment. The ore bridge and car dumper may be continually exposed to the elements; detrimental conditions, to be true, but capable of more or less standardization from the viewpoint of lubrication. We know in advance that ice, snow, hail and rain must be often encountered, therefore, we select our lubricants accordingly, especially for parts which may not be effectively enclosed.



Courtesy of Manning, Maxwell & Moore, Inc.

Fig. 2—An electric crane fitted with electro-magnetic hoisting equipment.

But electric cranes are different. Where the charging crane in an open hearth or soaking pit building may be subjected to abnormally high radiated heat, the overhead traveling crane in the storage yard may be exposed to the same conditions as the ore bridge.

Yet many operators are prone to regard crane lubrication as likewise capable of standardization. If they find a 1000 seconds Saybolt viscosity (at 210 degrees Fahrenheit) gear compound suitable to all ore bridge gears, on this same premise, a 2000 seconds viscosity lubricant is often regarded as best for all crane gears. Highest average operating temperatures being the basis for this assumption.

Averaging of conditions, however, is not practicable. Too many variables are involved. Where one crane may operate under cover in an atmospheric temperature of 100 degrees Fahrenheit, directly adjacent there may be a similar device in the yard, operating exposed to the weather. It is really fair to neither to attempt to standardize bearing, gear or wire rope lubricants to serve them both. Certain of the wearing elements of one or the other will be bound to suffer.

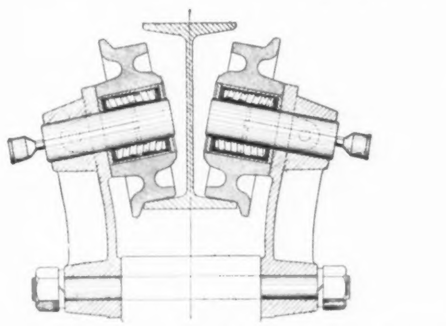
Especially is this true in cold weather when marked temperature differences may be involved. Bearing lubrication, for example, under such conditions, on an out-door crane may require oils of low pour test and comparatively low viscosity to insure the maintenance of an effective lubricating film, and the reduction of the possibility of congealment in the oil reservoirs. In effect an oil of at least zero degrees pour test and approximately 200 seconds Saybolt viscosity at 100 degrees Fahrenheit would be required.

While such a pour test would be immaterial in the case of lubrication of crane bearings in adjacent buildings, the viscosity would in all probability be too low, especially if the crane operates adjacent to heat appliances, furnaces, etc. In other words it would be necessary to give this matter of viscosity careful consideration and impress on operators that where one oil might be ideal for one condition, in another it might be relatively unsuitable to furnish lubricating films of the requisite viscosity.

Parts Requiring Lubrication

As stated, the electric crane involves an assemblage of electric motors, bearings, gears and wire ropes. Its general construction is clearly brought out in the accompanying illustrations, although, of course, all types

could not be shown. In effect, however, whether the jib, gantry, railroad or overhead traveling crane is involved, the principles of operation are essentially the same. In brief the electric motors serve to move the crane proper, the



Courtesy of Hyatt Roller Bearing Company

Fig. 3—Bearing details of a Shepard Electric Crane and Hoist Co. trolley supporting electric hoist.

trolley along the bridge and to rotate the hoisting drums. The gears serve to bring about the necessary speed reductions. Bearings are, of course, necessary to carry the gear and pinion shafts, trolley wheel journals and motor armatures; and wire ropes or cables are essential for actual hoisting of the grab buckets, hooks or electro-magnets which serve to carry the materials to be handled.

THE ORE BRIDGE AND UNLOADER

In the steel industry for the handling of ore to and from boats and cars, and in certain phases of the coal and rock products industries, the ore bridge, unloading bridge or automatic unloader are extensively used. Such devices are flexible, automatic and readily maneuvered with a minimum of labor.

In detail an ore bridge, or unloading bridge is very similar to an electric crane, consisting of a frame which is mounted on suitable end trucks or carriages; a runway or track for these latter to travel over; an overhead trolley capable of traveling along the bridge, and a grab bucket or electro-magnet arrangement which operates from the trolley.

In the unloading bridge that part from which the hoisting device operates is often either hinged to form a jib, or arranged so as to telescope within the main structure of the bridge. The object of such construction is to enable operation of the hoisting mechanism between the masts of ships or other obstacles.

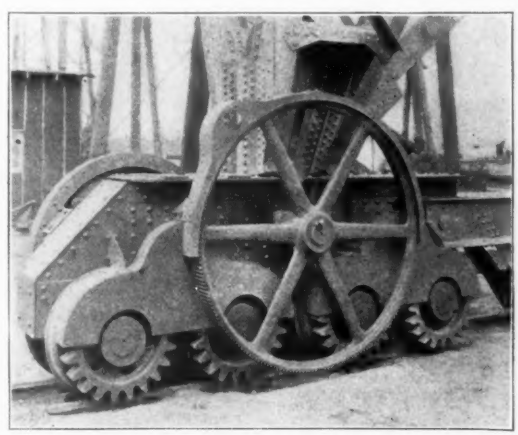
The Automatic Unloader

Another interesting device which is also widely used for the unloading of ore and coal from the holds of vessels, etc., is the automatic unloader. Essentially this device comprises a main framework which is mounted on trucks in a similar manner to a crane bridge. These trucks run along trackwork or runways on the wharf, thus enabling movement of the entire frame. On the bridge or framework is mounted a trolley which carries a balanced walking beam. From the outer or hoisting end of this latter is suspended a rigid hoisting leg with a grab bucket at the bottom. Within this leg are located the bucket operating gears, chains and other mechanism pertinent to horizontal motion. Vertical movement is brought about by operation of the walking beam.

Flexibility

By reason of the three-way motion available it is evident that an ore bridge or unloader can be readily and accurately located with respect to the hatch of a vessel, a car or the storage yard; and its hoisting media made to function with a maximum of delivery. In other words, after locating the bridge proper, the trolley or hoisting mechanism can be moved along the bridge until the grab bucket or magnet is above the product. It can then be lowered (according to the type of machine) filled or charged, and raised, to be discharged, after subsequent moving along the bridge according to the location of the point of discharge.

While the electric crane will frequently have the advantage of being located under a housing, with the result that its wearing parts will be more or less protected from the elements, the ore bridge and unloader will, as a rule, be located in the open, along with the car dumper,



Courtesy of Mead-Morrison Mfg. Co.

Fig. 4—Truck of an ore bridge showing gears and the method of guarding same.

and other types of such equipment which are used for handling materials in bulk. As a result its operating elements will require the same careful attention from a lubricating point of view.

Importance of Lubrication

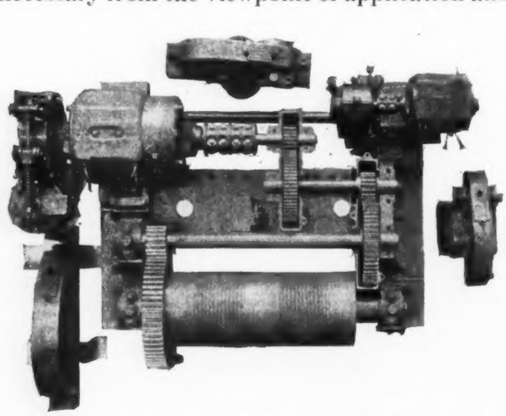
Ore bridge and unloader lubrication is essentially a matter of counteracting the effects of detrimental weather conditions by the use of oils, greases and gear and wire rope compounds which are especially capable of protecting the wearing elements.

Primarily the lubricants should be selected with the utmost care; the management must appreciate that in most cases such products will be called upon to function in the open, subjected to widely varying temperature conditions, and frequently in the presence of rain, snow and ice. Furthermore, many of the wearing elements to be lubricated will be located in more or less inaccessible or hazardous parts, where labor will have a tendency to neglect in the interests of personal safety.

In consequence, gear, wire rope and bearing lubrication on such equipment will differ markedly from that involved under more favorably housed conditions in many other industries. Then again, there will always be a certain amount of abrasive foreign matter or dust in the air which will have a tendency to become agglomerated with the lubricants to ultimately cause scoring and abnormal wear.

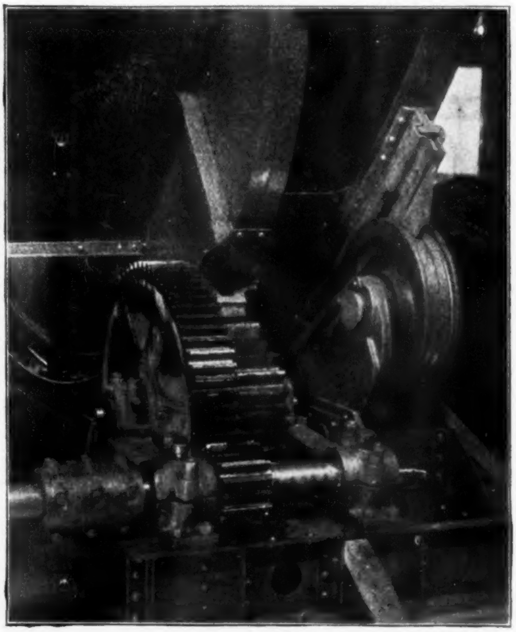
It must be borne in mind that on much of such materials handling equipment but few provisions for bath or enclosed lubrication are possible. As a result the maximum of protection is absolutely necessary from a lubricating point of view.

To stop with careful selection would leave the job but half done. Quite as much attention is necessary from the viewpoint of application and handling of oils and greases. For this reason progressive plants, as a rule, will insist on a regular lubrication schedule, in many cases holding individual operators directly responsible for the efficiency of operation of their respective machinery. In one particular instance of an ore bridge, the excellent record of but one bearing renewal in nine years has been the result of such an arrangement. Here lubrication of all wearing elements is attended to twice daily, by mechanics who have been educated to the importance of the proper application of lubricants.



Courtesy of Harnischfeger Sales Corp.

Fig. 5—View of a typical electric crane trolley. Note provision for grease lubrication of many of the bearings. In operation all gears are guarded to insure safe and effective lubrication.



Courtesy of The Wellman-Seaver-Morgan Co.

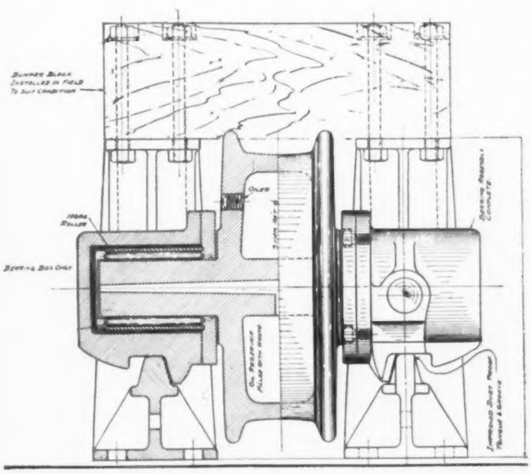
Fig. 6—Detail of end gearing and equalizer of a revolving car dumper. Note that bearings are grease lubricated with compression cups. Effective gear lubrication is extremely important on such equipment.

THE CAR DUMPER

In the handling of coal ore and other products from cars to storage yards or bins the motor-driven car dumper or unloader is a valuable piece of equipment due to the ease, rapidity and economy with which it accomplishes an otherwise dirty job.

In principle the car dumper, as its name implies, involves a huge tilting or lifting mechanism which actually tips a car to empty the contents via a chute into the storage yard, bin, hold of a boat or, perhaps, other cars. In general it is quicker and involves less labor than emptying cars via bottom hoppers or by grab bucket methods. It is extensively used for open top cars handling coal at railway terminals, in the loading or coaling of ships, and the delivery of ore to blast furnace storage and mixing bins. The same principle has also been extended to the unloading of closed cars such as are used for transporting grain and sugar cane.

In construction the car dumper involves a structural steel frame, which carries a cradle or cage in which the car is held during the process of unloading. By means of an automatic clamping arrangement the car is held rigidly in this



Courtesy of Car-Dumper and Equipment Co.

Fig. 7—Details of a car dumper supporting trunnion assembly. This is self-aligning, self-oiling, equipped with roller bearings and dust proof. Oil is forced into the reservoir inside the hollow trunnion from which it passes through the hollow shaft to the roller bearings.

position, being tilted sufficiently to empty the contents, or completely overturned according to the design.

Electric power is in general used to operate a car dumper, two motors being necessary, one for operating the clamping mechanism, the other for tilting or rotating the cradle or cage. The actual media for operating the latter, however, may be hydraulic pressure actuating a plunger connected to the cradle or cage, or a suitable arrangement of gears and cables. Where the car is to be completely overturned, the cage is supported on heavy trunnion wheels.

Machinery of this type must be massive, for gross loads of up to, perhaps, 100 tons must be carried with speed, safety and reliability. In consequence the operating mechanisms are designed with the utmost care. The necessarily large gears, heavy bearings and other equipment which this involves place an unusual responsibility upon the operator after such a machine is installed, due to the exacting lubricating requirements.

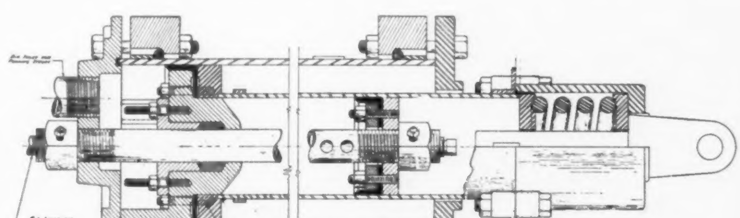
For lubrication is the primary means by which such equipment can be kept ready for continuous and efficient operation. The loads involved in handling a 70 or 90-ton gondola car are enormous and impose a duty on bearings and gear teeth, which in other industries would be frequently considered prohibitive. To meet these conditions the lubricants employed must be so refined as to maintain a lubricating film capable of resisting any squeezing out action, and also with adequate fluidity and low pour test to function under low temperature conditions. Car dumpers are exposed to the elements, located very frequently on the coast or Great Lakes where cold, wind, rain, hail, snow and ice must be met and counteracted. Hence the caution regarding low pour test or set point, where selecting lubricating oils, greases and gear compounds.

ELECTRIC MOTORS

The fact that materials handling equipment of this nature is, as a general rule, electrically driven renders the electric motor of especial interest. The operating efficiency of such machinery, in many instances, will be largely contingent upon the efficiency of its driving motors. In fact, any failure of the latter to function according to their rating may materially affect those operations which they are supposed to maintain.

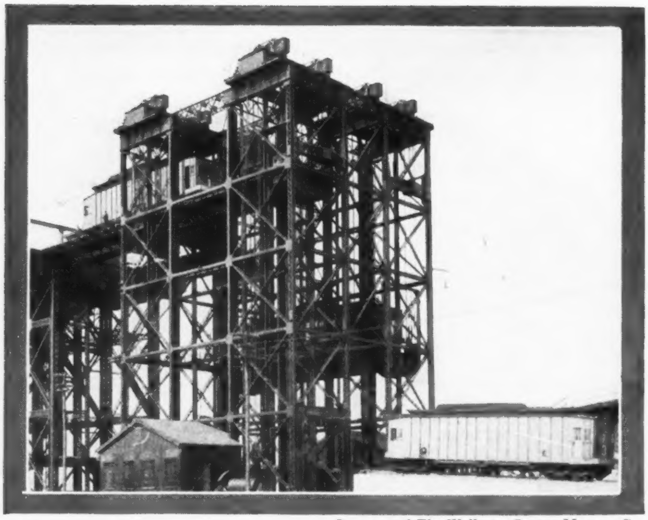
As has been stated in the October, 1925 issue of LUBRICATION, the efficiency of the electric motor is, in turn, directly dependent upon the efficiency of its lubrication. The motor involves perhaps the most delicate mechanisms to be found in this field of materials handling equipment. And yet it is frequently subjected to the most grueling service along with the adjacent gears and wire ropes.

These latter, by virtue of their comparatively massive construction and the nature of their lubricants are more capable of withstanding the frequently extreme duty imposed by wide temperature fluctuations, inequalities in pressure, dust, dirt, water and other contaminating foreign matter.



Courtesy of Car-Dumper and Equipment Co.

Fig. 8—Air cylinder assembly detail for car handling and unloading equipment. Lubrication is effected by passing oil into the air line at the operating valve.



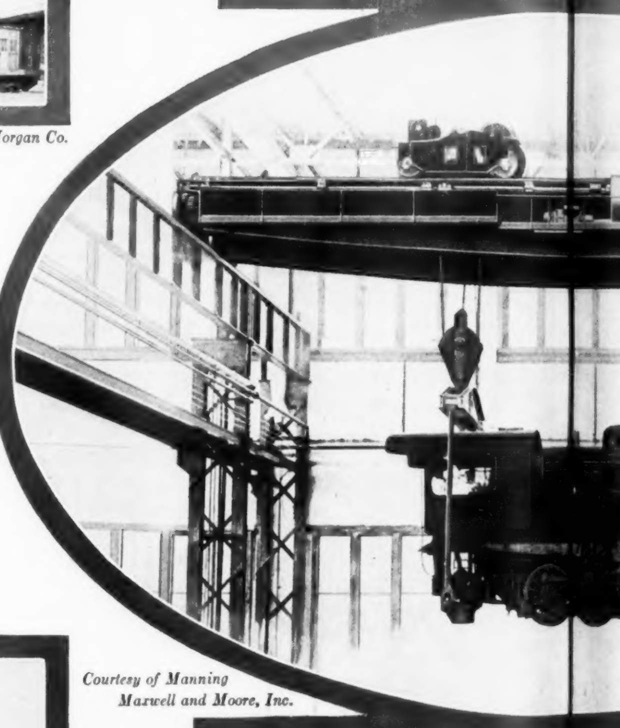
Courtesy of The Wellman-Seaver-Morgan Co.

Above.—View of a car elevator. Heavy loads, weather, and other conditions impose exacting requirements upon both the hoisting media and lubricants on such machinery.

Top Center.—The ore bridge in operation. Note the length of this device, and the ore boat at the dock.

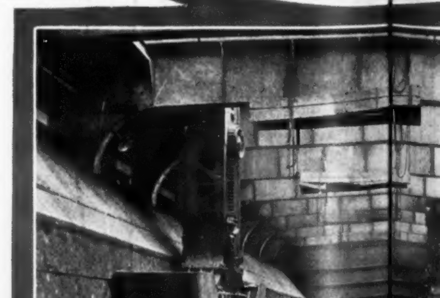
Bottom Center. Hold view of a W-S-M automatic ore unloader showing grab buckets being maneuvered by the bucket legs to gather the maximum load.

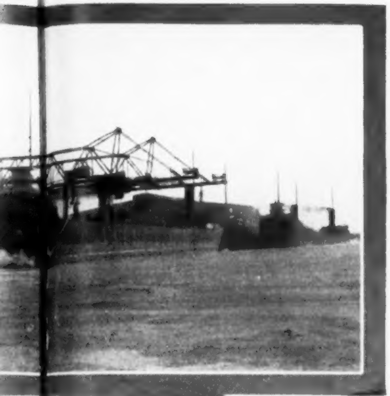
Below.—Deck view of a set of W-S-M automatic ore unloaders. Note walking beam, the hoisting or bucket leg and bridge relationship.



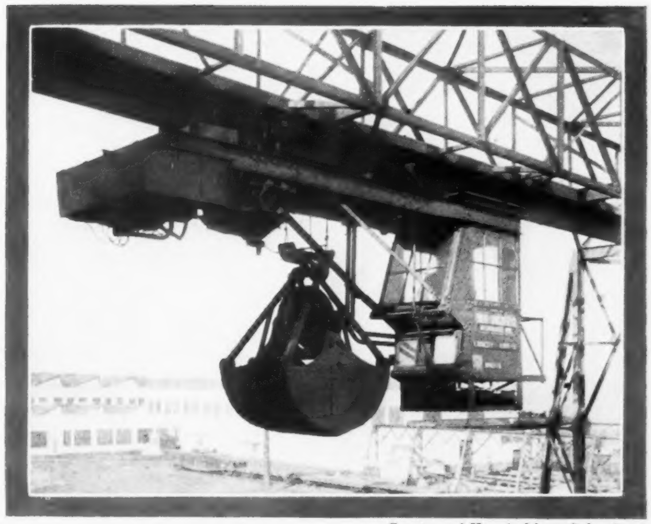
Courtesy of Manning Maxwell and Moore, Inc.

Courtesy of The Wellman-Seaver-Morgan Co.



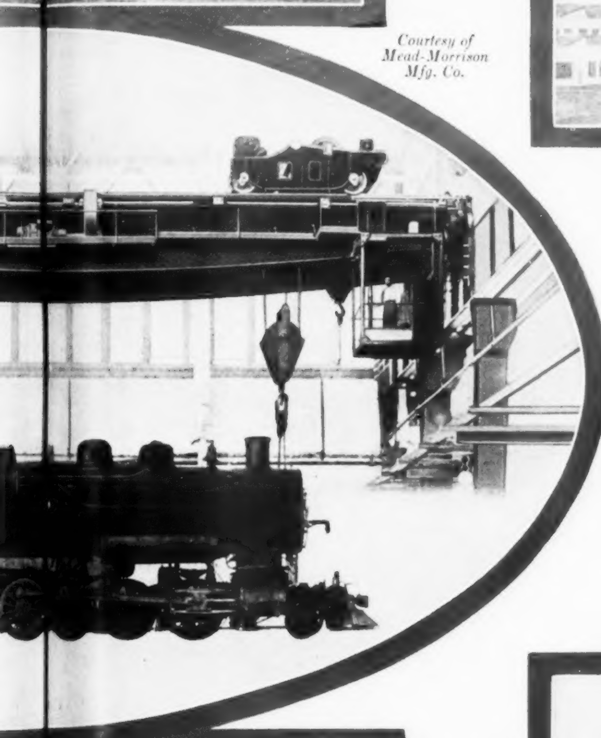


Courtesy of Mead-Morrison Mfg. Co.



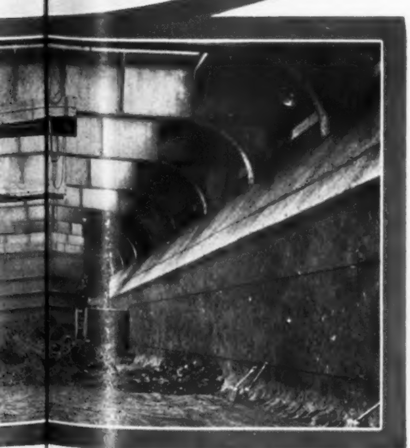
Courtesy of Harnischfeger Sales Corp.

Above.—Trolley and bucket of an electric crane. Here the former moves along a monorail. Note proximity of operator's cab.

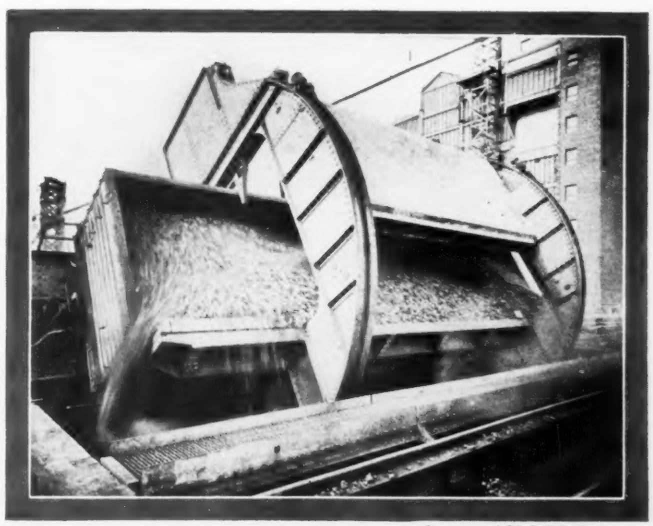


Center.—The ease with which the electric crane will handle heavy loads is clearly brought out in this view. But to do this, of course, all wearing elements must be perfectly lubricated, in the interests of safety and efficiency.

Below.—A gondola car dumper starting on its cycle of operation. This is a one-man operated machine, power being supplied by two electric motors. The huge loads which must be carried naturally require the most careful attention to lubrication.



Courtesy of The Wellman-Seaver-Morgan Co.



Courtesy of Link-Belt Company.

Electric motor bearings under such conditions require the most careful attention to their lubrication. Especially is this true of older types of motors which may not be provided with the necessary guards and baffles to effectively seal the oil reservoirs, etc., against the entry of such foreign matter, or to prevent windage from carrying oil into the windings to cause burn-outs.

Motors equipped with ring oiled bearings, will under average or lower temperature conditions require an oil from 180 to 200 seconds Saybolt at 100 degrees Fahrenheit. To meet the possibility of operation in cold weather as may be involved in the handling of out-door cranes, car dumpers, ore bridges, etc., this oil should have as low a pour test as possible to insure against congealment or sluggish flow which might materially affect circulation of the oil by the rings, with consequent overheating of the bearings.

On the other hand, where motors with similar bearings must function under conditions of comparatively high radiated heat as, for example, in many parts of the steel mill it has been found more practicable to use an oil of somewhat higher initial viscosity, ranging from 300 to 500 seconds Saybolt at 100 degrees Fahrenheit. Thereby will a more dependable oil film be assured, for it must be remembered that the viscosity or body of this film will be decreased under higher temperatures.

Where electric motors are equipped with ball or roller bearings, grease lubrication must also be considered. As a result special attention is called to the October, 1925 issue of LUBRICATION wherein this subject of Electric Motor Lubrication was discussed in extensive detail, with emphasis on the selection of suitable lubricants for ball and roller bearings.

WIRE ROPE LUBRICATION

This is one of the most important factors in any plant where materials in bulk such as ore, coke or coal are to be handled. For the ultimate efficiency of operation is, to a large extent, dependent upon the condition of the cables or wire ropes. We can easily realize that a rope with one or two broken strands due to rusting or wear traceable to improper lubrication, may not only cause a tie-up of the entire machine if such strands interfere with the operation of sheaves, or other companion cables, but may also present a distinct hazard. Any wire rope in such condition is just that much weaker and less capable of handling the imposed loads.

Visualize how important this might be in the case of a car unloading device, for example, where loads approximating 100 tons are frequently handled.

The Occurrence of Friction

It is not enough to assume that because such ropes come from the manufacturers in a lubricated state, being in general wound on an oil-saturated core, that further lubrication is unnecessary. Under operation there is constant friction and wear between the strands, and a tendency to squeeze out any contained lubricant; especially when the ropes pass over sheaves or around drums. The renewal of this product is, therefore, an absolute necessity.

The matter of friction between the strands of a wire rope is essentially the same as friction between a bearing and shaft. Over-heating and abnormal wear will practically always result, to reduce the load carrying capacity and increase the amount of power consumed in operation. This can only be overcome by effective lubrication, brought about by the proper application of a suitably prepared wire rope compound, which will be capable of not only penetrating to the innermost strands and core of the rope, but also sufficiently adhesive and viscous to resist being prematurely squeezed out or washed off by rain.

Courtesy of A. Leschen and Sons Rope Co.

Fig. 9—A typical aerial tramway which embodies the heavy duty friction grip system. The use of wire rope under conditions as shown requires the most careful attention to lubrication.

Character of Wire Rope Lubricants

Essentially a wire rope lubricant, in addition to the properties mentioned above, must not tend to cake, gum or ball up, especially if con-

taminated with an excess of dust, dirt or metallic particles. Furthermore, it must be resistive to the thinning-down effects of higher temperature. This, of course, directly involves the viscosity or relative fluidity of the product. In fact, viscosity of such products is the essential characteristic involved in purchasing. It should not, however, be assumed as being the chief guide as to the actual suitability of a wire rope lubricant.

In this regard the ability of the latter to function, penetrate and stick under actual operating conditions, is of outstanding importance. In consequence such products should not be purchased haphazardly, nor on a price basis alone. The potential difficulties that might result are too serious.

According to the operating temperatures that may be involved, and the possibility of the presence of an excess of water, the viscosity of a wire rope lubricant should be 1000 seconds Saybolt at 210 degrees Fahrenheit or somewhat lower. In warm climates, adjacent to ovens, furnaces, etc., where there might be possibility of such a product thinning down to the extent of dripping off to perhaps result in lack of lubrication, it will be advisable to use a lubricant of approximately 1000 seconds viscosity, of course, in accordance with the temperature prevalent.

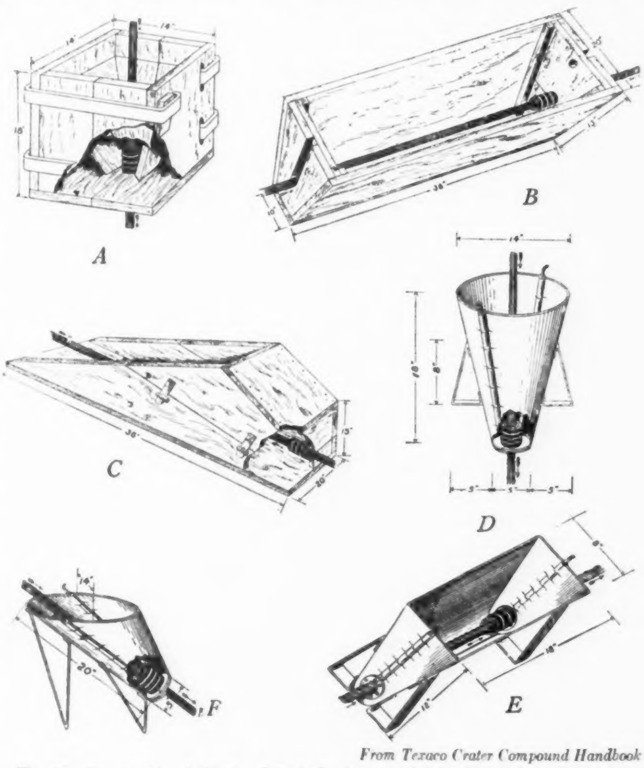
On the other hand, under relatively cold conditions as might be involved adjacent to the Great Lakes, in Canada or the Northwest, it would be advisable to use a somewhat thinner product, again in accordance with the range of operating temperatures involved.

Wire rope lubricants to meet the aforesaid requirements should, in general, be straight mineral petroleum products, devoid of fillers or thickening mediums. In other words, whatever the viscosity, it should be an inherent property of the lubricant, not an artificial characteristic which cannot be depended upon.

It is for this reason that greases or soap thickened mineral oils are relatively unsuited to wire rope lubrication. To attain the requisite body a comparatively high percentage of soap would be necessary. Soap, of course, serves as the carrying medium for the oil. It has relatively no lubricating value, therefore, this property in the resultant product is decreased to a marked extent. Furthermore, the adhesive characteristic of greases is low. In consequence such products will not, in general, meet the requirements of wire rope lubrication.

Application of Wire Rope Lubricants

As a general rule wire rope lubricants, by virtue of their viscosity and inertness, must be applied in heated condition. To merely attempt to daub or paint a rope with such a product at normal temperatures would be relatively impossible. Even though the surface might be more or less coated, the possibility of penetration occurring to any extent would be remote. We must realize that this latter is the secret of effective wire rope lubrication. The amount of wear occurring between the exterior of such a rope and the sheaves is not as marked as that which occurs between adjacent strands when the rope is flexed or bent as in passing over sheaves, or hoisting drums.



From Texaco Crater Compound Handbook

Fig. 10—Constructional details of typical wire rope lubricating and treating boxes. A, B and C are of wooden construction. A, to treat a vertical rope; B, a horizontal rope; and C, a rope located at an angle. D, E and F are similar boxes of metal construction.

A very satisfactory method of treating wire ropes is to use a form of box as illustrated in Fig. 10, according to the angle of the rope in question. Such a box can be readily built in the average plant, with suitable provision for rendering it sufficiently tight to prevent the lubricant from leaking out even when reduced in viscosity by heating. The slow passage of the rope through such a bath of heated compound will insure that not only will the surface be coated, but also that the requisite penetration takes place to the inner strands.

Further working of the rope over the sheaves before the lubricant has time to cool entirely, will tend to aid in bringing about the maximum of penetration.

GEAR LUBRICATION

In certain types of such materials handling machinery, notably the unloader, etc., gears and chains both play an important part in the operation of the hoisting mechanisms. In certain cases they will be enclosed, but in many others they will be exposed to the elements. Especially in the handling of ore and coal will such gears also frequently operate in an atmosphere of abrasive dust and dirt which will tend to penetrate the lubricating film on the teeth, or become mixed with any excess of this product to act in much the same manner as a valve grinding compound. Therefore, gear lubrication and lubricants require very careful attention.

Courtesy A. Leschen and Sons Rope Co.

Fig. 11—An automatic track oiler for long lines. Note reservoir for lubricant, the supporting trolley pendant and other details of construction.

In the selection of suitable lubricants to meet such conditions, there are four distinct characteristics that require consideration, viz:

1. *The viscosity*, which should be commensurate with the method of lubrication, the amount of heat that may be encountered and the pressures involved between the teeth. Relative to these factors it is apparent that the lubricant must possess sufficient body to not only resist the squeezing out action due to pressure, but also the tendency towards increased fluidity which is brought about by higher temperatures.
2. *Sufficient "oiliness"* or lubricating ability in order that abnormal power losses may not accrue due to solid and fluid friction. In addition the greater the lubricating ability the more readily will the gears and chains function on a minimum of lubricant.
3. *A maximum of adhesiveness* in order that the lubricant, when used under exposed or semi-enclosed conditions, will maintain a sufficient film on the teeth and effectively resist the action of centrifugal force.
4. *The least tendency to crack, congeal or harden.* Under low temperature conditions such action might easily interfere with lubrication to a marked degree. In turn, under higher temperatures there should be no tendency of the lubricants to carbonize and chip off, for this would have the same effect, with the result that the teeth might suffer materially.

Probably the most important factor requiring consideration relative to gear lubrication is the matter of pressure. As a rule the pressures will be high, and the bearing surfaces, due to their relatively small areas of contact will carry heavy loads. The more carefully and accurately the gears have been cut, the more intense will be the pressures, inasmuch as line contact will practically exist under such conditions. Furthermore, this line of contact or pressure will be constantly changing as the gear teeth mesh with each other. It will, of course, also change with the direction of application of the load.

As long as rolling motion predominates, the effect of the above on the structure of the teeth will not be serious. But once wear has begun to take place sliding motion will supplant rolling motion to a proportional extent and grinding of the surfaces will result. This explains the more or less rapidity with which gear teeth will become worn down whenever their lubrication has been neglected.

BEARINGS

Even more inaccessible than gears, or the wire rope cables in many electric cranes, ore bridges, etc., are the bearings which carry much of the shafting involved. As a general rule they are comparatively large and subjected to conditions of operation wherein some

form of automatic lubrication is practically mandatory.

Oil Lubrication

For this purpose where oil lubrication is desired or essential, some form of sight feed drip cup, waste pad oiler, or ring oiling system is usually employed in connection with plain bearings. Where ball or roller bearings are involved, however, as is true with certain types of crane motors, their lubricating systems form part of the bearings themselves. In such cases, especially where bearings are oil-tight and dust proof, one charge of oil or grease will insure effective and automatic lubrication for several weeks, according to the intensity of operation and the capacity of the bearing for the lubricant in question.

Courtesy of American Steel and Wire Co.
Fig. 12—A device for lubricating wire rope as it passes over a sheave. Here a relatively fluid lubricant is called for as indicated.

Sight feed drip cups, if properly installed are in general dust proof, oil-tight and automatic just as long as they contain sufficient oil to feed to the bearings. In many cases, however, they will require manual adjustment, and in practically every instance their re-filling will necessitate shut-down of at least part of the machine. These facts may be objectionable especially where such cups are located on outboard bearings which might be difficult and dangerous for the operator to reach. Futhermore, oil cups will require re-filling at comparatively frequent intervals.

Waste pad or wool yarn oiling systems are also used on the bearings of certain electric cranes, hoists, ore bridges, and other such equipment. Where the oiling reservoir is of sufficient depth and capacity to hold a goodly amount of waste or yarn, and where provided with a suitable dust cover, such a means of lubrication will function quite as satisfactorily as a railway car wheel journal box. In fact both are based on the same principle, and the latter is extensively used on the trucks of many traveling cranes, ore bridges and unloaders.

In principle, waste or wool pad lubrication is based on the saturation of wool waste with oil, the former serving as a carrier and retainer, to prevent premature or too rapid flow of oil through the bearings. Likewise it serves as a filtering medium to prevent dust and dirt from coming in contact with the bearing. To function effectively and insure automatic lubrication for as long a period as possible, it is important to use only the highest grade of long fibred wool yarn or waste, packing it (in railway type of journal bearings especially) most carefully to prevent rolling or dragging under the journals or shafts and, permit of perfect flow of oil at all times. This matter of the packing of journal bearings has been discussed in detail in LUBRICATION for January, 1925.

The oil for such systems may be either a grade of car oil refined to meet climatic conditions, or a straight mineral machine oil, according to the location and type of reservoir or oil well. In any case it should have a sufficiently low pour test to insure proper fluidity in cold weather. As a general rule under conditions involving operation much below 40 deg. F. an oil of some 400 to 500 seconds Saybolt viscosity will serve the purpose. In warm weather a heavier bodied lubricant of from 750 to 1000 seconds viscosity will, in general, meet the average requirements of waste pad or journal box lubrication.

Ring Oilers, in turn, constitute the means of lubrication on many other bearings. Of any, these are perhaps the most nearly automatic being capable of operating for several weeks without attention or re-filling. The design, construction and principles of operation of ring oiled bearings was discussed in detail in LUBRICATION for April, 1924 and October, 1925. Where bearings of this nature function under normal conditions a medium viscosity straight mineral machine oil of from 180 to 200 seconds Saybolt will, in general, give the best results. Such an oil, if of the proper base and highly refined, will have a sufficiently low pour test to meet the usual run of cold weather temperatures and still have the requisite body at normal temperatures to maintain an effective lubricating film.

Under higher temperatures, however, or in event of low speed and high pressure operation it will be advisable to resort to a heavier

oil of from 400 to 500 seconds Saybolt viscosity. Especially will this hold true in the case of steel mill cranes or others operating indoors and perhaps adjacent to heating ovens, furnaces, boilers or other conditions of steam or heat treatment.

Grease Lubrication

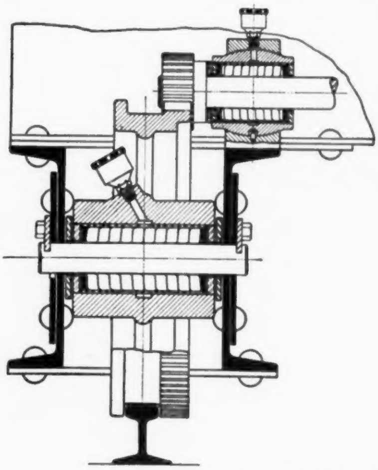
In view of the necessity for a means of lubrication that will function relatively automatically and be capable of withstanding the hard knocks so prevalent in such service, the grease cup is also extensively used on many of the shafts and sheave bearings of the electric crane, unloader and other equipment of this nature. In many cases such bearings, as stated, are located in dangerous and inaccessible positions, where regular oiling, or the filling of oil cups, etc., would be comparatively difficult or even impossible without complete shut-down.

Grease lubrication by means of the hand or spring regulated compression cup or the relatively automatic pin type of cup is therefore regarded by many engineers as an effective means of keeping such bearings operating with a minimum of care and the least amount of danger to the operators. Where hand regulated compression cups are involved it requires but a moment for the operator to reach in and screw down the regulator. Usually this can be done with but little danger while the machine is in motion. On more inaccessible parts, however, an automatic spring pressure or pin type cup will even eliminate this necessity, requiring attention only when it is to be refilled or cleaned.

By reason of the fact that such lubricators may easily become clogged, especially when functioning in an atmosphere of dust and dirt, it is advisable to clean them out and flush the bearings regularly to prevent accumulations of foreign matter therein. This, of course, can be carried out at the regular inspection periods, with perfect safety, when the machine is shut down. A properly constructed, tightly covered grease cup should, however, effectively prevent the entry of an excess of dust and dirt via the oil ways, and the film of grease at the outer edge of the bearing should keep foreign matter from penetrating at this point.

Under such conditions the selection of suitable greases is most important. However adaptable may be the means of lubrication, it cannot be depended upon if greases unsuited to usage therein are used. The essential factors requiring consideration in this regard are solubility and consistency.

Inasmuch as such lubricants must frequently function under water conditions, they must of course be compounded from the highest grades of mineral oils and insoluble soaps. We can



Courtesy of Hyatt Roller Bearing Co.

Fig. 13—Details of the bearings of the bridge wheel of a traveling crane. Note provision for grease lubrication by means of compression cups.

readily appreciate that the use of water-soluble soaps in particular might easily lead to imperfect lubrication due to impairment of the body of the grease and premature flow of the lubricating oil through the bearings. The soap constituent is the carrier for the oil, and as such must retain it in a perfect state of mixture, to be capable of feeding it to the bearings according to their requirements.

The requisite consistency of grease to use will in turn be dependent upon the type and size of the bearings, the pressure involved and the variety of grease cup used. Compression cups will, in general, function best on relatively solid greases. Pin type cups, on the other hand, involving either temperature or a certain pumping action in the attainment of flow of the grease will require products of lighter consistency.

It is relatively impossible to make specific recommendations in this regard. Operating conditions, machine design and construction, temperatures involved and the class of labor available will all be prone to exert too marked an influence. As a result the matter of grease lubrication should be discussed in detail with a capable lubricating engineer, who is versed not only in the details of machine operation, but also intimately familiar with the capabilities of each of the several grades of greases available to choose from.

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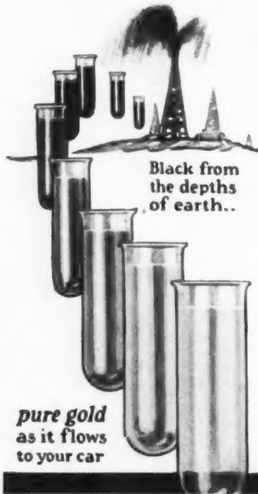

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